

ABSTRACT

The field emission type electron source device of the present invention includes: a field emission electron source portion including an extraction electrode provided on a p-type silicon substrate via an insulating film and having an opening portion at a position corresponding to a region where a cathode is provided; and a cathode portion provided on the p-type silicon substrate and at a position corresponding to the opening portion of the extraction portion; and an n-channel field effect transistor portion provided on the p-type silicon substrate, corresponding to the field emission electron source portion. The field emission electron source portion is provided in a drain region of the field effect transistor portion. A control voltage is applied to a gate electrode of the field effect transistor portion to control a field emission current from the field emission electron source portion. The drain region includes at least two wells having different impurity concentrations. Of the at least two wells, one well having a low impurity concentration is provided at an end of the drain region which contacts a channel region of the field effect transistor portion.